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GEOGRAPHIC VARIATION IN THE SEA SNAKE,
HYDROPHIS ORNATUS (GRAY).

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In discussing *Hydrophis ornatus*, Smith (1926:82) says, "Apart from the marked sexual variation in the number of scale-rows upon the neck and body, there is considerable variation in different regions. . . . The number of dorsal cross-bars is variable and independent of geographical distribution." As defined by Smith, *Hydrophis ornatus ornatus* extends from the Persian Gulf to China and the Ryu Kyu Archipelago, and east to New Guinea and the Gilbert Island, giving way to *H. ornatus inornatus* in the Philippines, and *H. ornatus ocellatus* in Australia and adjacent Papuasias.

An examination of the data published by Smith (1926) and certain specimens in the United States National Museum, leads me to believe that Smith's race *ornatus* is a compound form, and that certain attributes of structure and pattern are correlated with geographic distribution.

For example, if Smith's ventral count data are studied, it will be observed that in nine males from various localities in the Persian Gulf, Indian Ocean, Gulf of Siam, and Java (hereafter referred to as the Indomalayan population), the counts vary from 226 to 260. In 11 male specimens from Cochin China, China, and the Ryu Kyu Archipelago (hereafter referred to as the Chinese population), the ventrals range from 209 to 252. That the ventral counts of these two geographic samples are statistically different, is shown by the following tabulation:

Sample	Ventral Count Ranges and Frequencies	
	209 - 229	230 - 260
Indomalayan population	1	8
Chinese population	8	3

Application of the chi-square test of association indicates that these dispersions are highly significant, i.e., that the chances of the observed differences having arisen from random errors of sampling are considerably less than one in a hundred. Analysis of Smith's ventral count data for 11 females indicates a similar geographic variation. Thus, in

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six Indomalayan females the ventrals range from 224 to 312; two of the specimens have counts of less than 281 (244 and 250). In five Chinese females the ventrals range from 236 to 258. If the ventral count data for all 15 male and female Indomalayan specimens are pooled and then compared with the equivalent data for the 16 Chinese specimens, the following comparison may be made:

<i>Sample</i>	Ventral Count Ranges and Frequencies	
	209 - 240	242 - 312
Indomalayan population	4	11
Chinese population	12	4

These dispersions result in the highly significant chi-square value of 7.2; the distributions of the ventral counts of the two samples, as given above, will correctly separate 74% of the specimens according to geographic provenance.

A study of Smith's dorsal scale counts confirms the geographic segregation heretofore suggested. The body scale counts of 11 Chinese males range from 33 to 43, while those of the Indomalayan males range from 40 to 45. Nine out of 11 Chinese specimens have counts between 33 and 39, and the remaining two specimens have counts of 41 and 43. Conversely, all nine Indomalayan specimens have counts of 40 or more, so that if 39 is considered the arbitrary critical breakover point, we find that 18 (or 90%) of the 20 specimens can be correctly separated as to geographic origin by the body scale counts. Counts for the females of the two samples show a broad overlap, and do not permit a geographic separation, although there is evidence that with additional data such a split might become more apparent; the body scale count for Indomalayan females ranges from 43 to 55 (mean 48.5), while that of Chinese females varies from 39 to 51 (mean 45.6).

The neck scale counts are quite distinctive for the two samples. Nine Chinese males have counts between 28 and 31, and two have counts of 32 and 33 respectively. By contrast, only one Indomalayan male has a count lower than 32 (31), while the remaining eight vary from 32 to 37. Thus, 85% of these specimens are geographically separable on the basis of their neck scale counts. Females show a similar disparity; five out of six Chinese specimens have counts between 31 and 37, while the sixth specimen has a count of 39. In all six Indomalayan specimens the count is 38 or more (range 38-45). Hence, 11 out of 12 females (91%) are determinable on the basis of the neck scale count.

In addition to these differences, Chinese specimens (as pointed out by Smith, *loc. cit.*) have the posterior sublinguals well-developed, while Indomalayan specimens have these scales reduced. Smith believes that the number of dorsal cross-bars is independent of geographic distribution, but certain data appear to refute this idea. Thus, Smith says that three specimens from the Gulf of Siam have 38, 30, and 38 cross bars respectively, while two from Cochin China have 49 and 59 bars apiece. Four snakes from Ishigaki Shima, Ryu Kyu Archipelago (♀, ♂, ♂, ♂) have 54, 47, 47, and 51 bars respectively. It would seem, so far as these limited data go, that specimens from the coasts of Cochin China

and the adjacent seas to the north and east have a greater number of cross bars than do more westerly specimens.

In view of the foregoing analyses, *Hydrophis ornatus ornatus* (Gray) may be diagnosed as follows: ventrals 226-260 (♂), 244-312 (♀); neck scales 31-37 (♂), 38-45 (♀); body scales 40-45 (♂), 43-55 (♀); posterior sublinguals reduced; dorsal cross bars approximately 30-38; Persian Gulf, Indian Ocean, Java, and the Gulf of Siam.

This definition does not embrace the population occurring on the coasts of China, Cochin China, and the Ryu Kyu Archipelago, which, lacking a name, may be designated as

***Hydrophis ornatus maresinensis*, n. ssp.**

Distira godeffroyi Stejneger (*non* Peters), Herp. Japan, 1907: 430, figs. 352-354.

Hydrophis ornatus M. Smith, Monogr. Sea-Snakes, 1926: 81 (*part.*).

Type: USNM 33933 (♀), Ishigaki Shima, Ryu Kyu Archipelago, April-May, 1899; A. Owston, collector.

Paratypes: USNM 33934-6, same data as type.

Diagnosis: Ventrals 209-252 (♂), 236-258 (♀); neck scales 23-33 (♂), 31-39 (♀); body scales 33-43 (♂), 39-51 (♀); anterior and posterior sublinguals about equal in size; dorsal cross-bars approximately 47-59.

Distribution: Ryu Kyu Archipelago; Cap St. Jacques (Cochin China) to Tsingtao (Shantung Province), China.

Remarks: In the type and paratypes the third and fourth supralabials enter the orbit, as they commonly do in the typical race. The infra-labials are invariably 10, while the supralabials are 8 on six sides and 7 in the remaining two. The anterior temporals are single in all four specimens, with three of the specimens bearing two posterior temporals, and the fourth specimen with three posterior temporals. Preoculars one in all specimens, postoculars two on seven sides, three on the remaining one. Maxillary teeth posterior to the fang 12, 12, 13 in the three paratypes. The dorsal cross-bars are five or six scales wide on the dorsal mid line, and in two specimens they narrow to a single scale's width and continue across the abdomen, while in the other two specimens the cross bars end rather abruptly at about the tenth scale row.

Smith (*loc. cit.*) has included four specimens from southwest New Guinea, the Gilbert Islands (co-types of *Hydrophis godeffroyi* Peters), and the Bismarck Archipelago, in *Hydrophis ornatus ornatus*. These specimens (all four are females) appear to me to be on the whole much closer to *H. ornatus ocellatus*, and probably should be assigned to that race. The scale counts of these Papuan specimens are as follows:

	Ventrals	Neck Scales	Body Scales
Gilbert Isls.	269, 285	33, 35	39, 42
Bismarck Arch.	263	34	46
S. W. New Guinea	284	41	53

These Papuan specimens differ sharply in their ventral counts from *maresinensis* females, and somewhat less so from *ornatus* females, al-

though an average difference of six scales separates the mean counts of the Papuasian specimens (mean 275) and those of the *ornatus* females (mean 281). The neck scale counts of the Papuasian specimens separate them from *ornatus* females with but little overlap, and slightly less so from the *maresinensis* females. The body scale counts of the Papuasian specimens do not serve to separate them from either *maresinensis* or *ornatus*, being approximately intermediate between these two races. To sum up: the Papuasian specimens are distinct from *maresinensis* on the basis of the ventral scale counts, and show a moderate overlap in the neck scale counts; from *ornatus* they differ most markedly in the neck scale counts, and only partially on the basis of the ventral scale counts.

Comparison of the scale counts of the Papuasian specimens with those of two female and five male *H. ornatus ocellatus* (as reported by Smith, 1926: 84) from Australia and adjacent waters, does not reveal the close affinity which geographic proximity would suggest. However, if the average scale counts of the Papuasian specimens are compared with the combined averages for both sexes in *ornatus*, *ocellatus*, and *maresinensis*, it is obvious that they are closer to *ocellatus*, as will be seen in the following tabulation:

Sample	No. of specimens	Scales		
		neck	body	ventrals
<i>ornatus</i>	15	36	44	253
<i>maresinensis</i>	16	32	40	233
<i>ocellatus</i>	7	35	48	288
Papuasia	4	35	45	275

In view of the fact that geographic proximity, and structural affinity in two out of three characters, suggest alliance with *ocellatus*, it may be concluded that the four Papuasian specimens are best considered as belonging to that race.

The new race, *maresinensis*, does not appear distinguishable from the Philippine race, *inornatus*, on the basis of the neck, body, or ventral scale counts. However, the two races are separable by virtue of the narrower head in *inornatus*, in which the width of the head at the posterior edge of the supraoculars is less than half the length from the rostral to the posterior edge of the parietals; in *maresinensis* the width is more than half this length. Further, *inornatus* usually has two anterior temporals, while *maresinensis* has one; the maxillary teeth in *inornatus* are usually 10 or 11 (rarely 12), and are 12 or 13 in *maresinensis*; finally, *maresinensis* is boldly barred on the dorsum at all ages, while *inornatus* is a uniform gray above in all but the youngest specimens.

The four races of *ornatus* may be separated according to the following synopsis¹:

A. Male

1. Ventrals 246-290; body scales 45-49; flanks ocellated and spotted (rarely uniformly gray in old specimens). North Aus-

¹Subsequent to this writing, I have had an opportunity to study the data given by Bourret (*Les Serpents marins de l'Indochine Francaise*; 1935) for certain

tralian coast from Broome to the Hawkesbury River; West New Guinea; Aru Islands; Gilbert Islands; Bismarek Archipelago.-----*Hydrophis ornatus ocellatus*

Ventrals 195-260; body dorsal scales 33-45; either boldly barred above, or uniform gray ----- 2

2. Head narrower (width at posterior edge of supraoculars less than half the length from rostral to posterior edge of parietals); maxillary teeth (excluding fangs) usually 10 or 11; adults uniform gray above, pale white below (juveniles with obscure, narrow bands). Manila Bay and Palawan.

Hydrophis ornatus inornatus

Head width greater (width at posterior edge of supraoculars more than half the length from rostral to posterior edge of parietals); maxillary teeth (excluding fangs) more often 12 or 13; boldly barred above ----- 3

3. Ventrals 226-260 (230-260 in 89% of specimens); neck scales 31-37 (32-37 in 89% of specimens); body scales 40-45 (100% of specimens); cross-bars about 30-38; posterior sublinguals reduced. Indomalayan seas, from the Persian Gulf to the Bight of Bangkok-----*Hydrophis ornatus ornatus*

Ventrals 209-252 (209-229 in 72% of specimens); neck scales 28-33 (28-31 in 81% of specimens); body scales 33-43 (33-39 in 81% of specimens); anterior and posterior sublinguals about equal; cross bars approximately 47-59. Ryu Kyu Archipelago; Cap St. Jacques (Cochin China) to Tsingtao (Shantung Province), China-----*Hydrophis ornatus maresinensis*

B. Female.

1. Ventrals 222-278 (222-264 in 82% of specimens); neck scales 31-39 (31-36 in 78% of specimens); body scales 39-51 (39-45 in 78% of specimens) ----- 2'

Ventrals 244-336 (265-336 in 75% of specimens); neck scales 33-45 (37-45 in 75% of specimens); body scales 39-55 (46-55 in 67% of specimens) ----- 3'

- 2'. Head narrower (width at posterior edge of supraoculars less than half the length from the rostral to the posterior edge of the parietals); maxillary teeth (excluding fangs) usually 10

Annamese and Cochin-China specimens of "*Hydrophis ornatus*." For the most part, this author's discussion is taken from Smith (1926); however, certain of his data (p. 43) shed additional light on the variations of *H. o. maresinensis*.

To judge from Bourret's data, specimens from Annam and Cochin-China (Phan-Thiet, Cap. Kéga, Cap. St. Jacques) are intermediate between *ornatus* and *maresinensis*. Unfortunately he has not given the sex of his specimens, so that it is difficult to make valid comparisons with other available data. However, on the basis of his ventral counts, his specimens appear (at least seven out of nine, and perhaps eight out of nine) to be females; if this surmise is correct, then so far as ventral counts are concerned, his specimens are much closer to *ornatus*. However, counts of neck scales, body scales, and cross-bars agree quite well with *maresinensis*. It would appear best, as suggested by these data, to consider southern Indochina (Cochin-China and southern Annam) a region of intergradation between *ornatus* and *maresinensis*.

or 11; adults uniform gray above, pale white below (juveniles with obscure, narrow bands). Manila Bay and Palawan.

Hydrophis ornatus inornatus

Head wider (width at posterior edge of supraoculars more than half the length from rostral to posterior edge of parietals); maxillary teeth (excluding fangs) usually 12 or 13; adults boldly barred above. Ryu Kyu Archipelago; Cap St. Jacques (Cochin China) to Tsingtao (Shantung Province), China.

Hydrophis ornatus maresinensis

- 3'. Neck scales 33-42 (33-37 in 67% of specimens); increase in scale rows from neck to body 6-15 (12-15 in 67% of specimens); flanks ocellated and spotted (rarely uniformly gray in old specimens). North Australian coast from Broome to the Hawkesbury River; West New Guinea; Aru Islands; Gilbert Islands; Bismarck Archipelago..... *Hydrophis ornatus ocellatus*
Neck scales 38-45 (100% of specimens); increase in scale rows from neck to body 5-10 (100% of specimens); adults and juveniles with prominent cross-bars. Indomalayan seas, from the Persian Gulf to the Bight of Bangkok.

Hydrophis ornatus ornatus

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LITERATURE CITED

Smith, Malcolm

1926. Monograph of the sea-snakes (Hydrophiidae). London: Printed by order of the Trustees of the British Museum; xvii + 1-130, pls. 1-2, figs. 1-35.

Stejneger, Leonhard

1907. Herpetology of Japan and adjacent territory. Bull. U. S. Nat. Mus., 58: xx + 1-577, pls. 1-35, figs. 1-409.